

759

Honey Improves Fruit Cake Quality

By Loren B. Smith and John A. Johnson
Kansas State College

Honey Improves Fruit Cake Quality¹

By Loren B. Smith and John A. Johnson²
Kansas State College

THERE was a time when fruit cake was eaten primarily during the Christmas festive season. This does not appear to be true today. Fruit cake is made and sold during all seasons of the year. It is recognized as a rich type of cake that meets the approval of the most discerning hostess and guests.

Fruit cake quality characteristics differ from those of most other types of cake. Fruit cake is expected to slice well without undue crumbliness, and to remain moist over long periods of time. The crumb of fruit cake is desirable when a certain degree of chewiness is present. Chewy yet tender, and moist when combined with desirable flavor effects may be defined as good eating qualities of fruit cake. The eating quality of fruit cake should not deteriorate with reasonable storage time. Since honey flavors are derived from floral sources, their use in fruit cake should be complementary to that of the fruit.

The purpose of this research has been to determine how various floral sources of honey affect the eating quality of fruit cake. Studies were made of the effect of concentration of honey on moisture retention during storage. Organoleptic tests were employed to measure eating qualities.

Recognition of the power of honey to enhance the flavor of cake crumb as well as to improve moisture retention has been given by several investigators. (1,2,3.). Dunn and Bailey

TABLE I—EFFECT OF VARIOUS HONEYS ON RETENTION OF MOISTURE AFTER SEVEN DAYS STORAGE

Honey	Rank	Mean
Buckwheat	1	27.51
Spanish Needle	2	20.92
Fall Flowers	3	20.34
Tupelo	4	20.32
Horsenint	5	20.29
Cotton	6	20.07
Eucalyptus	7	19.91
Star Thistle	8	19.85
Sweet Clover	9	19.76
Orange	10	19.68
Arizona Alfalfa	11	19.57
Mesquite	12	19.41
Light Amber Alfalfa	13	19.38
Heartsease	14	19.35
White Clover	15	19.14
Sucrose	16	17.71

(4) observed that invert sugar imparted soft, spongy characteristics to biscuits while sucrose produced hard, brittle products. Since honey is composed, to a large extent, of invert sugar, it is reasonable to assume these effects also might be a property of honey. Dunn and Bailey associated the soft, spongy effects with moisture retention.

Improved Moisture Retention Of Cake Base

Preliminary studies on fruit cake base were conducted to demonstrate the effect of honey on moisture retention. A simple pound cake such as might be used as a base for fruit cake was employed. This base contained equal amounts of sugar, shortening, eggs and flour. Various honeys were substituted for all of the sugar. Moisture content of the crumb was determined after seven days storage. Results of the test (means in Table I) were subjected to statistical analysis which showed that honey held significantly more moisture in this cake crumb than sucrose. This work served to corroborate the evidence presented in the literature (1,4). An effort to correlate the means of Table I with

grading factors and chemical analysis (Table II) failed to show a significant relationship. The ability of honey to retain more moisture than sucrose is due apparently to something other than the analyzed chemical properties.

It should be noted that the quality of the cakes which were tested for moisture retention was poor. The effects of excessive browning (5), recognized as the Maillard reaction, caused dark crumb and off flavors. Both are characteristic of the browning reaction occurring when high honey concentrations are used. Therefore, when fruit cakes for storage testings were made, the honey concentration was lowered to 50% based on flour.

Fruit May Mask Moisture Retention

Fruit cakes containing each of the fifteen various honeys as well as sucrose were baked, weighed, wrapped and stored at room temperature for 120 days. Scoring was performed at periods of 14, 30, 60 and 120 days. The data for weight loss are given in Table III. It is evident that all the cakes lost weight as time of storage increased. Statistical analysis showed no significant differences between the sucrose and honey fruit cakes with regard to weight loss. It is believed that the effect of the added fruit which also retains moisture, was sufficient to mask any effects on moisture retention which might be due to 50 percent honey solids.

Slicing Quality and Flavor Improved

During the period between the time the fruit cakes were baked and the 120 day period, the scoring of the fruit cakes indicated that those cakes which contained honey possessed a superior slicing quality compared with the sucrose cakes. It was observed

¹ Contribution No. 227, Department of Milling Industry, Kansas Agricultural Experiment Station, Manhattan, Kan. A report of work, done under contract with the U. S. Dept. of Agriculture and authorized by the Research and Marketing Act of 1946. The contract is being supervised by the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry.

² Research Assistant and Associate Professor respectively, Department of Flour and Feed Milling Industry, Kansas State College, Manhattan, Kansas.

TABLE II. CHEMICAL ANALYSIS, COLOR AND GRADE OF HONEYS.

Honey	H ₂ O %	Color ¹	Ash %	N %	Acidity ² ml.	pH	Total ³ red. sugars %	Total ³ sugars %	Sucrose %	L/D ⁴	Dextrin %
Horsemint	19.8	40	0.21	0.11	56.5	3.6	73.2	77.1	3.7	1.08	0.32
Spanish needle	18.1	73	.20	.09	17.1	4.4	72.8	76.6	3.6	1.38	1.93
Buckwheat	19.7	119	.09	.21	38.1	3.9	72.0	75.5	3.3	1.06	.54
Fall flowers	17.8	111	.17	.14	28.8	4.0	75.3	78.4	2.9	1.02	.50
Cotton	16.4	26	.18	.09	25.4	3.9	76.9	80.3	3.2	1.02	.39
Sweet clover	17.1	25	.07	.00	16.0	3.9	73.6	80.4	6.5	1.22	.15
Mesquite	17.2	32	.09	.00	15.8	4.0	75.5	77.6	2.0	1.20	.20
Ariz. Alfalfa	15.1	44	.29	.01	20.4	4.0	76.9	80.3	3.2	1.03	.57
Star thistle	16.4	49	.13	.04	42.0	3.7	74.2	76.6	2.3	1.06	.64
Tupelo	18.8	54	.10	.03	18.4	3.9	72.0	74.2	2.1	1.39	.25
Eucalyptus	17.7	64	.24	.04	25.3	4.0	73.2	75.7	2.2	1.17	.43
White clover	15.9	22	.07	.00	16.5	3.8	76.7	80.8	3.9	1.06	.12
Orange	16.4	21	.07	.01	16.6	3.8	74.2	81.8	7.2	1.16	.19
Heartsease	17.0	50	.07	.05	20.6	4.0	76.8	80.3	3.3	1.09	.03
Lt. Amb. Alf.	15.4	53	.16	.06	22.0	3.9	76.9	81.9	4.7	1.19	.12

¹ Color in millimeters Pfund. Color classes of samples listed above in order are, extra light amber, light amber, dark amber, amber, white, white, white, extra light amber, extra light amber, light amber, light amber, white, white, extra light amber, light amber.

² Acidity reported as ml. N/10 NaOH per 100 g. honey.

³ Total reducing sugars and total sugars calculated as invert sugar.

⁴ Levulose-dextrose ratio.

also that those cakes containing honey were of better flavor than the sucrose cakes. Cakes containing buckwheat and fall flowers honeys were the only exceptions. Other strongly flavored honeys such as heartsease and horse-mint, which are usually regarded as of undesirable flavor, were not detected in the fruit cakes.

Organoleptic Tests

Observations made during the course of this study suggested that further testing was warranted employing an organoleptic panel to score the cakes for flavor and crumbliness. Fruit cakes were made with the following formula and procedure:

Ingredient	Percent
Flour	100
Shortening	90
Whole eggs	100
Salt	2.5
Sucrose	50
Honey solids	50
Sporban (mold inhibitor)	0.25

The control cake was made with 100% of the sugar as sucrose. Water was added to the control to keep the moisture content of all cakes constant and equivalent to that in the cakes containing honey. The batter weight was three pounds for each mix. To the basic batter was added a fruit mix, seedless raisins and nut meats totaling 5½ pounds.

The cakes were stored and tested at 20 and 110 day periods. Ten trained judges were asked to rank the cakes for flavor and crumbliness in a ran-

domized block experiment. Statistical analysis were made at the end of each testing period.

A summary of the judgments ranking the fruit cakes according to aroma and crumbliness are given in Table IV. For each honey, the mean rank was computed after pooling the score from the ten judges. Statistical analysis of these means for each test period showed, both for flavor and aroma and crumbliness, that the mean ranks for honey differed significantly as a group. It is evident that the judges observed a difference in aroma, flavor and crumbliness between the 20 and 110 day periods. The appeal of the honey apparently changes as the cakes were stored. Certain honeys were consistently ranked for aroma and flavor below that of other honeys. Thus fall flowers, Spanish needle and buckwheat honeys were ranked less desirable than other honeys. Cake made

with sucrose was considered less desirable than most of the honeys. The color of the honey did not appear to be in any way related to aroma and flavor effects. Since the color of cake is usually dark the color of the honey employed is not a factor of real significance.

Considering the crumbliness it will be noted when sucrose was the only sugar used that the rank changed from second on the 20 day test to 10 on the 110 day test. White clover, amber alfalfa, horsemint, Arizona alfalfa, thistle and orange honeys did not appear to improve the slicing quality or decrease the extent of crumbliness. Other honeys included in this study improved this characteristic. There does not appear to be any degree of relationship between any of the chemical properties and the properties of the honey that imparts slicing and eating quality to the fruit cake.

TABLE III—LOSS OF WEIGHT IN FRUIT CAKES DUE TO STORAGE *

Honeys	14 day loss	30 day loss	60 day loss	120 day loss
Sweet Clover	3	6	9	17
Mesquite	4	6	10	18
Ariz. Alfalfa	3	5	9	17
Star Thistle	3	6	10	16
Tupelo	4	4	10	18
Eucalyptus	3	4	11	14
White Clover	2	4	9	20
Orange	2	5	9	15
Heartsease	3	4	10	14
Horsemint	3	4	8	22
Spanish Needle	2	5	8	15
Buckwheat	3	4	10	18
Fall Flowers	1	3	9	13
Light Amb. Alf.	2	5	9	17
Cotton	2	5	12	17
Sucrose	3	6	12	18

* Grams of weight loss per pound of cake.

Tentative Proposed Specifications For Honey for Use in Fruit Cake

1. All honey containers should be clearly labeled, showing U.S. Grade, floral source, moisture content, and color in m.m. Pfund as well as U.S. Department of Agriculture color standards.
2. Honey for use in fruit cake should be U.S. Grade "A" or "B" according to "U.S. Standards for Grades of Extracted Honey", effective April 16, 1951.
3. Honey should be treated at 160°F for 30 minutes to retard granulation.
4. Predominant floral sources of buckwheat and fall flowers honeys are not recommended for use in fruit cake.

Acknowledgments

Grateful acknowledgment is given to: Dr. R. L. Parker, Department of Entomology, Kansas State College, for aid in obtaining certain honeys; to the American Beekeeping Federation for Grant-in-Aid; to Mr. Al Babcock, Cloverdale Honey Co-op, Inc., Fredonia, New York, and to Mr. Burel Lane, Finger Lakes Honey Producers Co-op, Inc., Groton, New York for furnishing certain floral sources of

honey and to Dr. J. W. White, Jr., and the Analytical, Physical Chemistry and Physics Division of the Eastern Regional Laboratory of the U. S. Department of Agriculture, for chemical analysis of the honeys and many helpful suggestions during the course of this research.

Literature Citation

1. WILLSON, R. B., Honey for the Baker.

Bakers Helper, May 15, (1949).

2. WALTON, GEO. P., A Sweetening Substance of Direct Interest to the Baker. *Bakers Weekly*, Aug. 20, (1945).
3. LOTHROP, R. E., AND L. H. BAILEY. Utilization of Honey in Commercial Baking and Other Industries. *Am. Bee J.* 78; 54-57 (1938).
4. DUNN, J. A. AND C. H. BAILEY. *Cereal Chem.* 5; 395-430 (1928).
5. SMITH, LOREN B. AND JOHN A. JOHNSON. The Use of Honey in Cake and Sweet Doughs. *Bakers Digest*, Dec. 1952.

TABLE IV — RANKS OF HONEY VS. SUCROSE IN FRUIT CAKES

Honey	AROMA AND FLAVOR		Honey	CRUMBLINESS	
	20 Days	110 Days		20 Days	110 Days
Mesquite	10	1	Buckwheat	6	1
Heartsease	7	2	Cotton	3	2
Thistle	1	3	Eucalyptus	5	3
Tupelo	9	4	Sp. Needle	9	4
Sweet Clover	11	5	Heartsease	7	5
Lt. Amb. Alf.	5	6	Tupelo	12	6
Eucalyptus	14	7	Fall Flowers	1	7
Ariz. Alf.	2	8	Sweet Clover	8	8
Orange	4	9	Mesquite	4	9
Fall Flowers	12	10	Sucrose	2	10
Sucrose	16	11	White Clover	11	11
Sp. Needle	13	12	Lt. Amb. Alf.	13	12
Horsemint	3	13	Horsemint	14	13
White Clover	6	14	Ariz. Alf.	15	14
Buckwheat	15	15	Thistle	10	15
Cotton	8	16	Orange	16	16